

HFT PXL Survey

Contents

Overview	1
Kin Mount Survey.....	1
PST Survey.....	3
Mock PST Survey.....	5
Sector Survey	5
PXL Half Survey	5

Overview

This document summarizes the survey of the PXL detector for STAR HFT. PXL is composed of 2 semi-circular structures, each of which supports 5 sectors. Each sector has 3 outer ladders and 1 inner ladder. Each ladder has 10 modules. The semi-circular PXL halves can be rapidly inserted and removed from STAR; they are located within STAR by 3 spring latching kinematic mounts.

The assembly hierarchy of the objects to be surveyed is:

- Pixel Support Tube (PST)
 - 3x Kin Mounts
- Mock PST
 - 3x Kin Mounts
 - 2x D-Tubes (1 per PXL half)
 - 10x sectors (5 per D-tube)
 - 30x tooling balls (3 per sector)
 - 40x ladders (4 per sector)
 - 400x modules (10 per ladder)

The survey occurs in five setups, described below.

Kin Mount Survey

Each kinematic mount is independently surveyed **before bonding into the support tubes**. Each mount has a 3-2-1 set of constraint features on its outer surface: a cone, a vee, and a flat, as shown in Figure 1. A separate plate with three $\phi 1/4$ " precision glass balls glued in it is temporarily screwed to the surface of the kin mount; the balls nest into the cone, vee, and flat. These balls define the coordinate system of the kin mount.

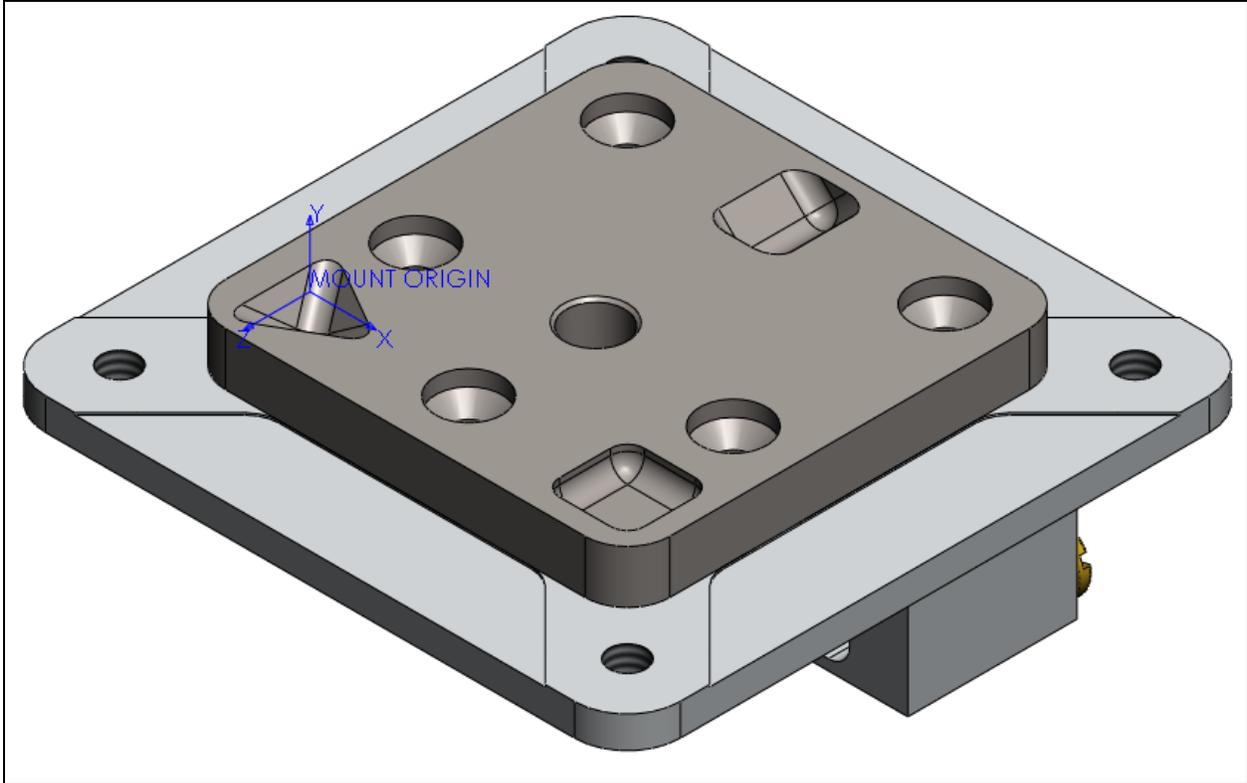


Figure 1. Kinematic mount outer plate has cone-vee-flat features to define a coordinate system (when appropriate survey balls are installed).

With respect to this coordinate system, on the underside of the kin mount there are several features to be measured. There are three types of kin mount:

1. Top West
 - a. has 6 silicon nitride tooling balls ($\phi 5/32''$) to be surveyed
 - b. 4 of the balls constrain the PXL halves in (X,Y)
 - c. 2 of the balls constrain the PXL halves in Z
2. Top East
 - a. same as Top West, except no Z-stop balls
 - b. measure all 4 (X,Y) balls
3. Bottom
 - a. has a central post
 - b. measure plane of the central flats on both sides of the post
 - c. the flats constrain the PXL halves in rotation about the Z axis

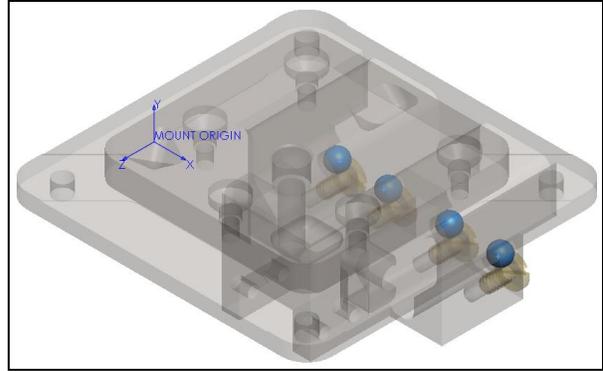
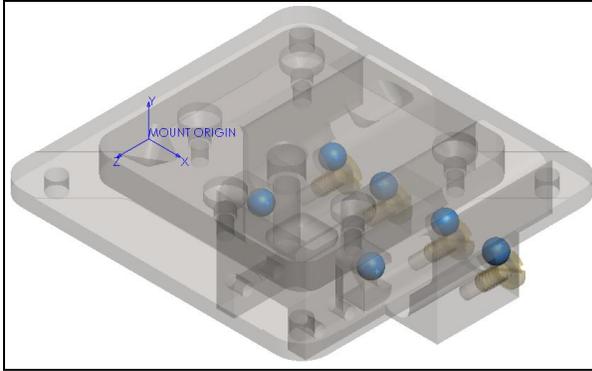


Figure 2. Left: west kinematic mount has 6 constraint balls: 4 (X,Y) and 2 Z. Right: east kinematic mount has 4 constraint balls only: 4 (X,Y).

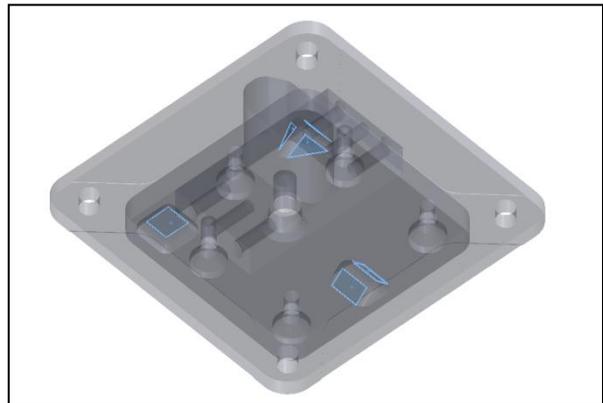
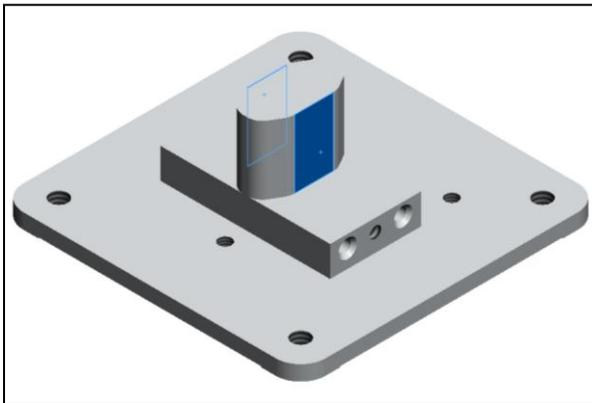


Figure 3. Left: bottom kinematic mount has a central post to be surveyed. It is the vertical flats (highlighted blue) on the post which are to be measured. Right: bottom kinematic mount has the same cone-vee-flat datums as the top versions.

There are 6 kin mounts. Three of these are permanently attached to the PST which resides in STAR. The other three mounts (nominally identical) are attached to a mock PST which resides at LBNL. All 6 kin mounts are bonded into the two tubes using the same Grand Master tooling jig.

PST Survey

After the kin mounts have been independently surveyed, they are bonded into the PST. Now a survey is performed to locate each mount with respect to the tube. The PST coordinate system ("PST" in Figure 4) is defined by three datums on its aluminum flange:

1. rear flat at $Z = 0$
2. horizontal pin hole at $X = 124.25$
3. the opposite horizontal slot at $X = -124.25$

With respect to PST coordinate system, the cone-vee-flats of each of the three kin mount positions / angles is measured. This locates the coordinate system of each of the mounts with respect to PST, as shown in Figure 5.

If possible, the (accessible) $\phi 5/32$ " Si_3N_4 balls in the kin mounts may be surveyed as a redundant check.

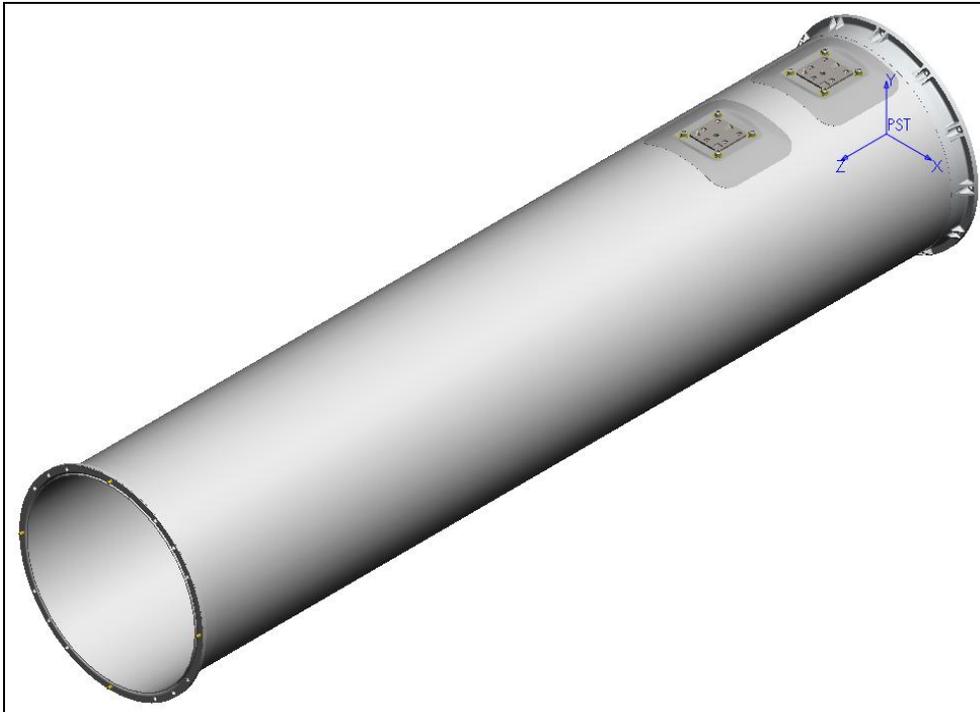


Figure 4. Pixel Support Tube (PST)

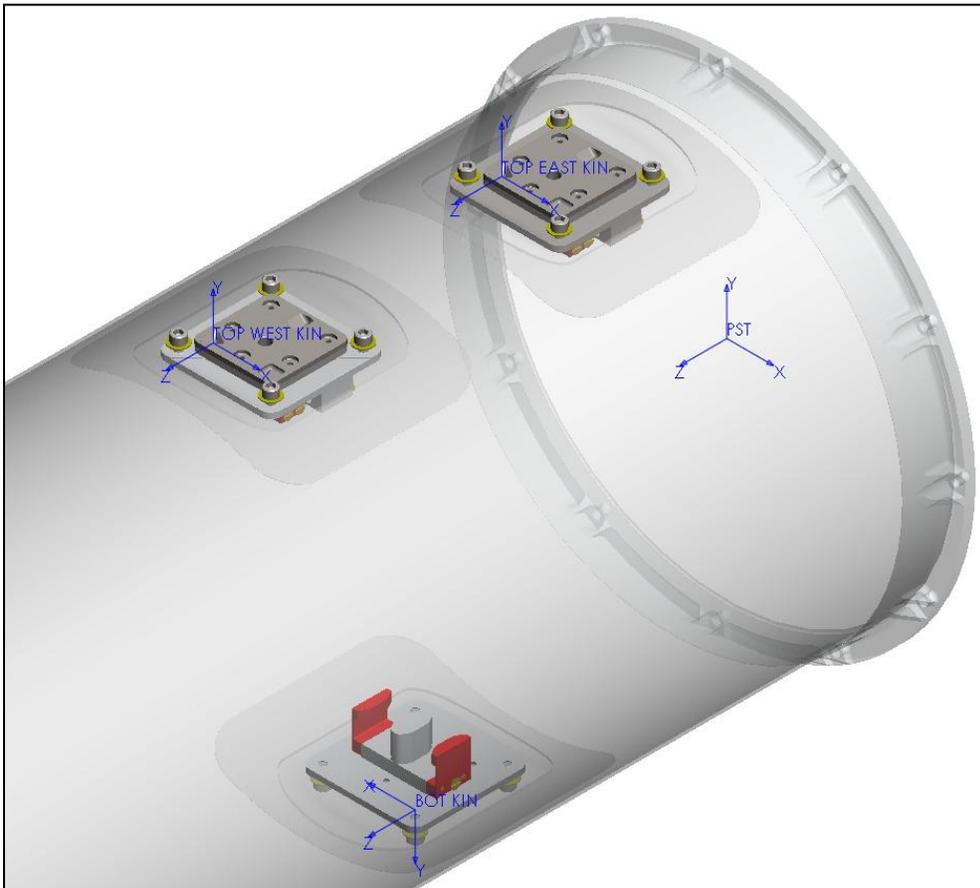


Figure 5. PST, closer view of kin mounts.

Mock PST Survey

The positions of the three kinematic mounts are surveyed in the Mock PST in the same manner as the PST. The Mock PST remains at LBNL, and is used subsequently when surveying PXL halves. The Mock PST is similar in materials and geometry to the PST, but is truncated to allow CMM probe access.

Sector Survey

Each sector is individually surveyed. The sector has 4 ladders (3 outer, 1 inner), each with 10 modules, as shown in Figure 6. It also has 3 precision tooling balls ($\phi 1/8$ " ceramic). The position of each of the 40 modules is measured with respect to the 3 tooling balls. The tooling balls define the sector coordinate system. The figure of the modules is also measured.

This survey is performed using a vision/touch CMM with a rotary stage.

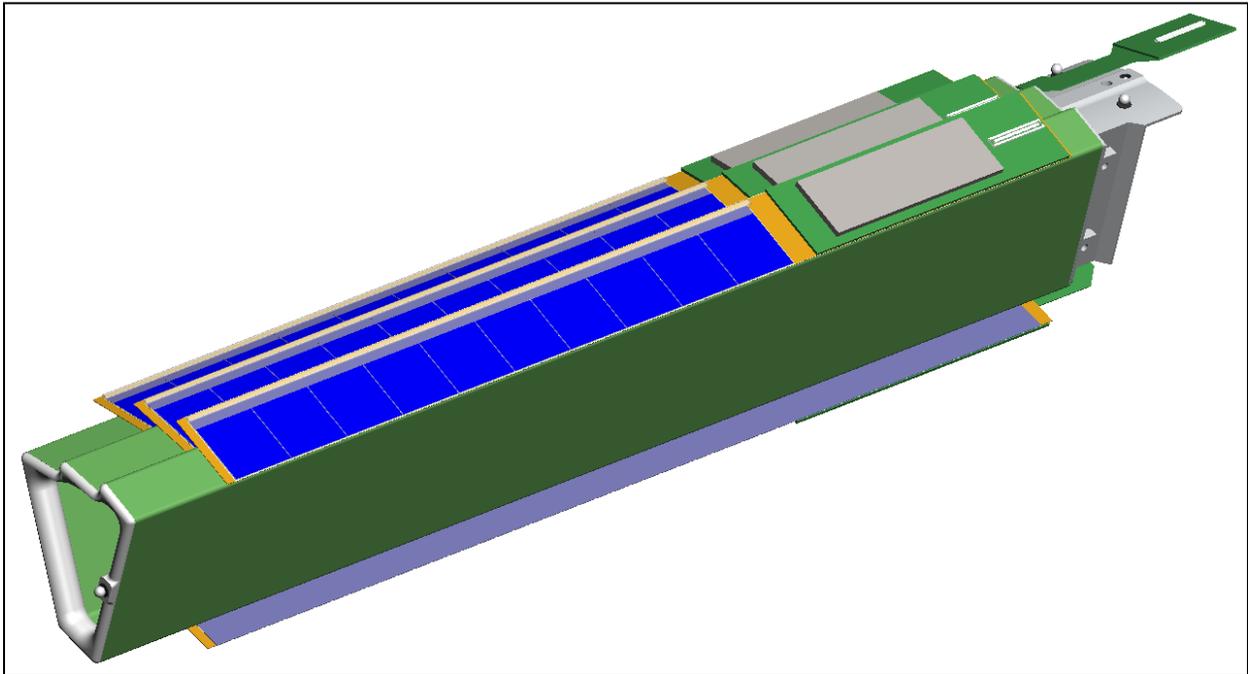


Figure 6. Sector, populated with 4 ladders (3 outer, 1 inner). Note 3x survey balls: two on the east side, one projecting west.

PXL Half Survey

Either a north or a south PXL half is clicked into the kinematic mounts in the mock PST. Each half has 5 sectors mounted on it. ***All five sectors must be mounted tight and secure before the survey -- any dismounting necessitates a re-survey. Loctite 222 (purple) the locking screw and apply a "DO NOT LOOSEN" label.***

The positions of the 15 ceramic tooling balls (3 on each sector) are surveyed with respect to the Mock PST coordinate system.

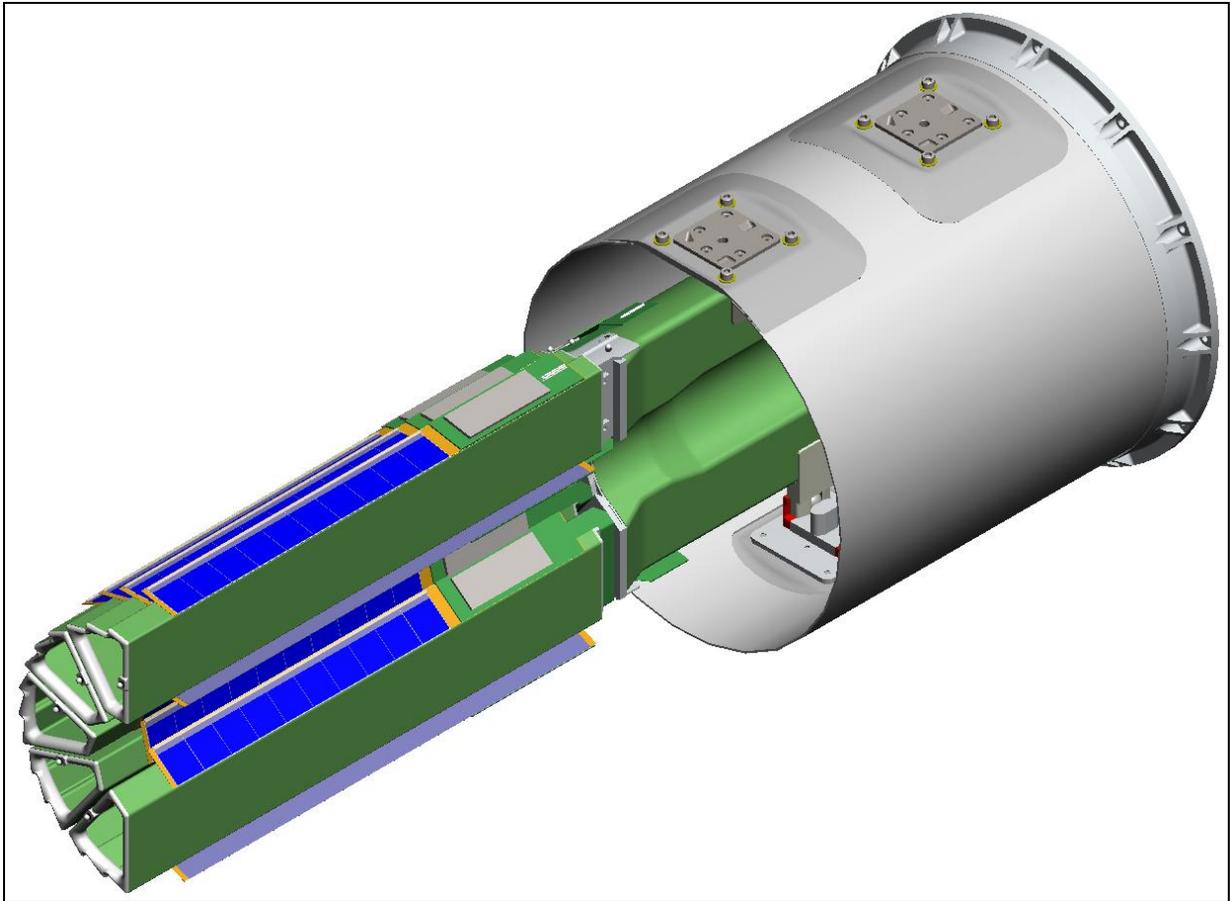


Figure 7. North PXL half in Mock PST (in this view, the mock PST is just a truncation of the PST).

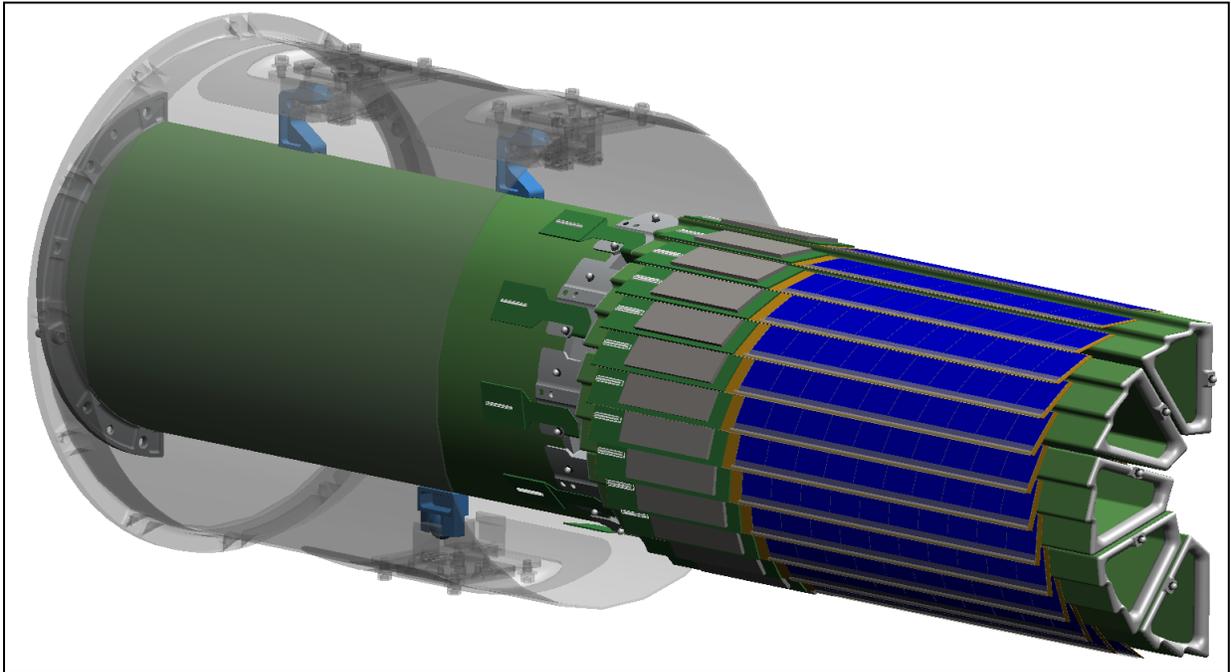


Figure 8. North PXL half in Mock PST. Kinematic hangers (highlighted blue) are clicked into the kin mounts. All 15 of the sector tooling balls are accessible.